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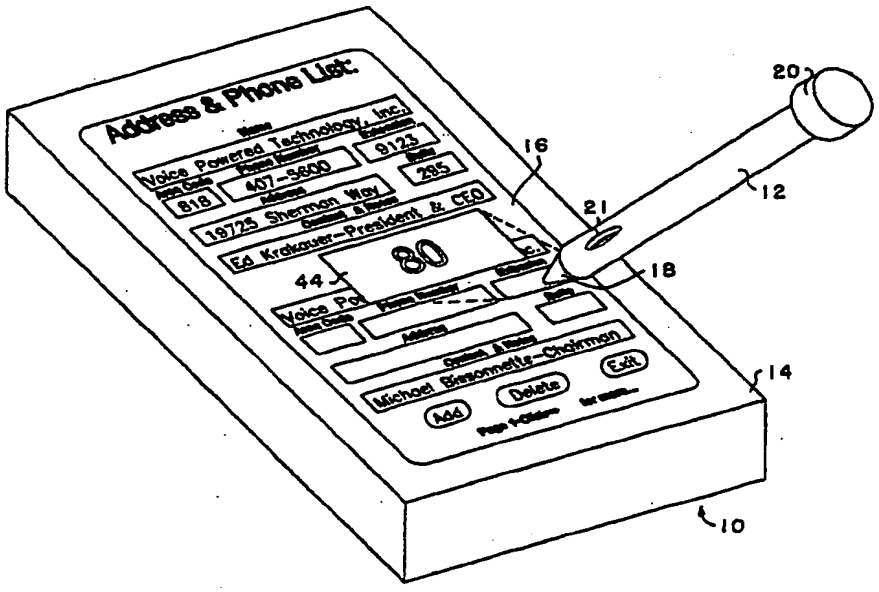

(57) Abstract

A voice and pointer operated system includes a pen (12) provided with a microphone (20) responsive to a voice command for providing a voice signal and an electronic device (14) having a pointer-responsive area in the form of a touch screen (16) thereon for interfacing with the pen (12) as well as apparatus for recognizing the voice signal and producing an action routine denoted thereby. The pointer responsive area (16) may comprise a touch screen presenting frames for interaction with the pen (12) to select function for the electronic device (14) with voice commands entered via the microphone (20) in the pen being used to provide input data to the electronic device (14). The pen (12) may be wireless or electrically coupled to the electronic device (14).

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VOICE/POINTER OPERATED SYSTEM

Background of the Invention

1. Field of the Invention.

The present invention relates to systems for entering data into a device using voice recognition of spoken words, and more particularly to systems capable of combining voice recognition with other forms of data entry such as by touching.

2. History of the Prior Art.

It is well known to provide an electronic device with a pointer member such as a pen or stick for purposes of inputting data into the device. Typically, the pen or stick is used to activate buttons and to highlight fields displayed on touch-screen displays. In addition, the pen or stick may be used to perform other functions, such as handwriting recognition. In such arrangements, the pen or stick provides a means of human interfacing whereby the operator may point to fields, frames or buttons to make selections or otherwise enter data into an electronic device, such as a personal computer, a personal organizer or a personal digital assistant (PDA). Additional data, such as that entered for purposes of recording or storage, is often entered by other interfacing means such as a keyboard or keypad.

Still other arrangements for inputting data into an electronic device are known. Among such arrangements are those which use voice recognition techniques to recognize voice commands entered by the user. Such electronic devices include systems in which remote controls are provided with sophisticated voice recognition electronics. The remote controls recognize spoken commands, translate the commands into the traditional remote digital control signals, and transmit the control signals to a controlled device. Examples of such systems are provided by co-pending application Serial No. 07/915,112 of Bissonnette et

al., entitled Voice Operated Remote Control Device, by co-pending application Serial No. 07/915,938 of Bissonnette et al., entitled Voice Recognition Apparatus and Method, and by co-pending application Serial No. 07/915,114 of Fischer, entitled Remote Control Device. All three applications were filed on July 17, 1992 and are commonly assigned with the present application.

A further example of an electronic device in which data is inputted using voice recognition is provided by co-pending application Serial No. 08/113,394 of Fischer et al., entitled Voice Operated Remote Control System, which application was filed August 27, 1993 and is commonly assigned with the present application. The Fischer et al. application describes a voice operated remote control system in which a remote control device responsive to the voice commands of a user transmits representations of the voice commands to a controlled device which then produces voice signals in response to the transmitted representations. The controlled device includes voice recognition circuitry for recognizing the transmitted voice commands and executing action routines denoted thereby. The remote control device receives the voice commands via a microphone and produces a corresponding analog audio signal which is modulated and then transmitted by an infrared transmitter. An audio receiver at the controlled device includes an infrared sensor for receiving the transmitted signal, and additional circuitry for demodulating and processing the transmitted signal into a corresponding voice signal. The voice signal is used to generate an incoming digital voice template for comparison with a plurality of digital reference voice templates. If a substantial equivalent is found, a corresponding action routine is executed to achieve a desired action within the controlled device.

Another electronic device utilizing voice recognition for data inputting is described by co-pending application Serial No. 08/134,327 of Bissonnette et al., entitled Voice Activated Personal Organizer, which application was filed October 12, 1993 and is commonly assigned with the present application. The Bissonnette et al. application describes a small, portable, hand-held electronic personal organizer which performs voice recognition on words spoken by a user to input data into the organizer, and records voice messages from the user. The spoken words and the voice messages are input via a microphone, and the voice messages are compressed and then converted into digital signals for storage. The stored digital voice messages are reconverted into analog signals and then expanded for reproduction using a speaker. The organizer is capable of a number of different functions, including voice training, memo record, reminder, manual reminder, time setting, message review, waiting message, calendar, phone group select, number retrieval, add phone number, security, and "no" logic. During such functions, data is principally entered by voice and occasionally through use of a limited keypad, and voice recordings are made and played back as appropriate. A visual display provides feedback to the user. During the various functions, the user can edit different data within the organizer by eliminating or correcting such data or entering new data.

While the electronic devices described in the above-noted co-pending applications incorporate a number of different advantageous features for human interfacing with such electronic devices so that data can be efficiently and effectively transferred, it may be desired for certain applications to provide further improvements in human interfacing with such devices. For example, it would be desirable to be able to select functions or otherwise input data via manual means

while simultaneously entering data specific to those functions by non-manual entries such as by vocal commands. Such an arrangement would provide an easy, intuitive human interface, allowing for both simultaneous and independent speech and touch inputting.

Brief Summary of the Invention

Briefly stated, the present invention provides a voice and pointer operated system in which a pen or stick responsive to voice commands is operative to input data into a device using voice recognition, in addition to data inputted into the device using a pointer or tip region of the pen or stick. The device has a pointer-responsive area thereon as well as voice recognition means for recognizing a voice signal from the pen and producing an action routine denoted thereby. The pointer-responsive area may comprise a touch screen presenting frames for interaction with the pen to select functions for the device, with voice commands entered via a microphone in the pen being used to provide input data to the device.

In a first embodiment of a voice and pointer operated system in accordance with the invention, the pen is electrically coupled to the device to provide the voice signal directly to the device. A wire extending between the pen and the device, and which is long enough to permit movement of the tip region of the pen to different areas of the touch screen, couples the microphone directly to the device to provide the voice signals thereto. The wire connection also enables the pen to utilize the power supply of the device.

In a second embodiment of a voice and pointer operated system, the pen is wireless, thereby eliminating the need for a wire or other direct connection between the pen and the device. Voice signals generated by the microphone of the pen in response to voice commands from the user are modulated

before being transmitted by the pen to an audio receiver within the device for conversion into the voice signal. The modulated voice signal may be transmitted by an infrared transmitter, within the pen, to an infrared sensor at the audio receiver within the device.

The voice recognition apparatus within the device may assume any appropriate form. In one example, such apparatus includes a reference memory for storing a plurality of reference voice templates, a program memory for storing a control program, and a processor for generating an incoming voice template in response to each voice signal which is received, in order to produce a voice signal corresponding to the transmitted representation. The control program is executed to determine whether the incoming voice template is substantially equivalent to one of the reference voice templates. One of a plurality of action routines is then selected, based on the reference voice template which the incoming voice template matches.

The device, which is controlled by the voice and pointer inputs of the pen or stick, may comprise such electronic devices as a computer, a personal organizer or a personal digital assistant (PDA). The device may, for example, comprise a personal digital assistant which is organized to operate as a phone directory for storing names, addresses, phone numbers and other information. In that event, various fields within a display on the phone directory are touched by the pen to select basic functions such as entry of an additional name or entry of digital information for a name already displayed, with the user then speaking into the pen to enter the specific data within such fields.

Brief Description Of The Drawings

The foregoing and other objects, features and advantages of the invention will be apparent from the

following more particular description of preferred embodiments of the invention, as illustrated in the accompanying drawings, in which:

Fig. 1 is a perspective view of a pen and a personal digital assistant, providing an example of a voice and pointer operated system in accordance with the invention;

Fig. 2 is a block diagram of a first embodiment of the system of Fig. 1 in which the pen is directly coupled by wire to the personal digital assistant;

Fig. 3 is an alternative embodiment of the system of Fig. 1 in which the pen is wireless;

Fig. 4 is a block diagram of the electronic portion of the pen of Fig. 3;

Fig. 5 is a block diagram of the audio receiver forming a part of the personal digital assistant of Fig. 3;

Fig. 6 is a basic flow chart illustrating the operation of the system of Fig. 1; and

Fig. 7 is a detailed flow chart illustrating a detailed example of the operation of the system of Fig. 1.

Detailed Description

Fig. 1 shows a voice and pointer operated system 10 in accordance with the invention. The system 10 of Fig. 1 includes a pen 12 and electronic device 14 with which the pen 12 is used. In the example of Fig. 1, the device 14 comprises a personal digital assistant (PDA). It should be appreciated, however, that systems in accordance with the invention may utilize other electronic devices such as computers and personal organizers which are adapted for voice and pointer operation, using the pen 12, in accordance with the invention.

The electronic device 14 includes a pointer-responsive area thereon in the form of a touch-screen 16. The pen 12 includes a pointer or tip region 18

thereof. Placement of the pen 12 to engage the touch-screen 16 by the tip region 18 results in the inputting of data into the touch-screen 16 in conventional fashion. In this connection, it should be understood that arrangements using other than physical touching can be used in accordance with the invention, including those in which the pointer-responsive area responds to infrared signals blocked by the pen 12. Any appropriate arrangement can be used in which the tip region 18 of the pen 12 interacts with the touch-screen 16 or other pointer-responsive area of the device 14 to input data therein, when placed in close proximity thereto.

In accordance with the invention, the pen 12 is provided with a microphone 20 mounted at an end of the pen 12 opposite the tip region 18. As the user speaks voice commands into the microphone 20, corresponding voice signals are provided to the device 14. The user presses a push-to-talk switch 21 on the pen 12 to signal the device 14 that voice commands are being transmitted thereto. As described hereafter, the device 14 utilizes voice recognition to input further data represented by the voice signals.

The pen 12 may be directly coupled to the device 14 by wire, as described hereafter in connection with Fig. 2. Alternatively, the pen 12 may be wireless and may transmit the voice commands to the device 14, such as by use of infrared techniques, as described hereafter in connection with Fig. 3. The manner in which the voice signals received by the microphone 20 of the pen 12 are conveyed to the device 14 is unimportant. What is important is that the system 10 of Fig. 1, as is true of systems in accordance with the invention, be capable of inputting data into the device 14 using both voice commands and pointing. Moreover, the voice commands and the pointing can be utilized to input data into the device 14 simultaneously.

It will be appreciated by those skilled in the art, particularly from the detailed description to follow, that systems in accordance with the invention such as the system 10 shown in Fig. 1 provide a greatly improved, and indeed a natural, human interface of the user with the device 14. The pen 12 can be used to point to a desired field or other area of the device 14, and thereby input data into the device 14 while simultaneously responding to the user's voice commands to input additional data into the device 14 in conjunction therewith. This enables the user to point to a desired field or frame of the touch-screen 16 within the device 14 while at the same time making choices and otherwise inputting data in connection with such field or frame using voice commands.

Fig. 2 shows an embodiment of the system 10 of Fig. 1 in which the pen 12 is directly coupled by wire to the device 14. As shown in Fig. 2, the microphone 20 of the pen 12 is coupled by a wire 22 to the device 14. The wire 22, which is long enough to provide the user with flexibility in pointing to different portions of the touch-screen 16, provides the voice signals which are generated by the microphone 20 in response to the voice commands of the user directly to a microcontroller 24 within the device 14. The user presses the push-to-talk switch 21 before speaking to signal the device 14 that voice signals are being transmitted thereto.

The microcontroller 24 forms a part of a voice recognition circuit 26, and includes an analog-to-digital converter (A/D) 28. The microphone 20 of the pen 12 converts words spoken by the user into analog voice signals, and the A/D converter 28 converts such signals into corresponding digital signals. The microcontroller 24 also includes a microprocessor (MP) 30 coupled to the A/D converter 28, and having access to both a read only memory (ROM) 32 and a random access

memory (RAM) 34. The microcontroller 24 is coupled to an external DRAM 36, which forms a part of the voice recognition circuit 26, and which is utilized for voice recognition storage requirements, including primarily the storage of voice templates.

The voice recognition apparatus shown and described in Fig. 2 is by way of example, and it should be understood that other apparatus capable of voice recognition can be used in accordance with the invention. For example, a digital signal processor (DSP) can be used to perform the voice recognition.

The microcontroller 24 comprising the voice recognition circuit 26 operates in the same manner as described in the previously referred to co-pending applications, Serial Nos. 07/915,112, 07/915,938 and 07/915,114. Such applications are incorporated herein by reference. As described in detail in co-pending application Serial No. 07/915,112, for example, the A/D converter 28 of Fig. 2 may comprise an 8-bit converter which samples incoming data at a preassigned frequency such as 9.6 KHz. The A/D converter 28 outputs a digital signal representing the input analog voice signal from the microphone 20. The microprocessor 30 processes the digital voice signal together with a voice recognition software routine forming part of a control program stored in the ROM 32. The digital voice signal is converted into an incoming voice template that is compared against previously stored voice templates of the user's voice stored in the external DRAM 36. The program decodes the voice templates. Together with the external DRAM 36, the RAM 34 comprises a reference memory for temporary storage of data.

Thus, the analog voice signal from the microphone 20 of the pen 12 is applied to the A/D converter 28 for conversion into an incoming digital voice signal. The reference memory, comprised of the external DRAM 36 in

conjunction with the RAM 34, stores a plurality of reference digital voice templates. The ROM 32 stores the control program. The microprocessor 30, which is coupled to the A/D converter 28, the ROM 32 and the RAM 34, generates an incoming digital voice template from the incoming digital voice signal at the output of the A/D converter 28. The microprocessor 30 then executes the control program to determine whether the incoming digital voice template is substantially equivalent to one of the reference digital voice templates stored in the reference memory comprised of the RAM 34 and the external DRAM 36. The microprocessor 30 determines what action to take corresponding to a reference digital voice template, if the incoming digital voice template is found to have substantial similarity to the reference digital voice template. Again, however, it should be understood that this description is by way of example only, and that other voice recognition techniques can be used in accordance with the invention.

The electronic device 14 includes a keyboard input 38. The keyboard input 38 is not essential but may be used, as in the present example, for manual entry of additional data into the microcontroller 24. The electronic device 14 also includes an audio circuit 40 coupled through a speaker or speakers 42 to provide audible messages to the user of the device 14.

The electronic device 14 of Fig. 2 includes a liquid crystal display (LCD) 44 coupled to the microcontroller 24 through an LCD display circuit 46. The LCD display 44, which provides a visual display to the user, forms part of the touch-screen 16 of the electronic device 14. The touch-screen 16 is responsive to the tip region 18 of the pen 12 to input data, with such data being provided to the microcontroller 24 by the LCD display circuit 46. The physical or touching relationship between the tip

region 18 of the pen 12 and the touch-screen of the LCD display 44 is represented by a dotted line 48 in Fig. 2.

The touch-screen 16 of the device 14 responds to the tip region 18 of the pen 12 to input data into the device 14 in conventional pen or stick fashion. In addition, however, and in accordance with the invention, data is also input into the device 14 using the microphone 20 of the pen 12 and the voice recognition capabilities of the device 14. As previously described, the microphone 20 responds to vocal commands of the user by providing the analog voice signals to the microcontroller 24 comprising a portion of the voice recognition circuit 26. The microcontroller 24 attempts to recognize the voice signals, and when such recognition occurs additional data is input into the system. In this fashion, data inputted into the device 14 by voice command is combined with data input by touching the touch-screen 16.

Fig. 3 shows an alternative embodiment in which the pen 12 is not coupled by the wire 22 to the device 14, as in the case of Fig. 2. Instead, the pen 12 is wireless and transmits representations of the voice commands of the user to an audio receiver 50 within the device 14. The audio receiver 50 in turn converts the transmitted signals into the voice signals for application to the microcontroller 24. The microcontroller 24 performs voice recognition on the voice signals in the same manner as described in connection with Fig. 2.

Thus, the device 14 of Fig. 3 is like that of Fig. 2, except for the presence of the audio receiver 50. The pen 12 of Fig. 3 is like the pen of Fig. 2, except that it transmits the vocal commands to the audio receiver 50 in wireless fashion. Because the pen 12 of Fig. 3 is not directly coupled to the device 14 of Fig.

3 by wire, the pen 12 must have its own power supply. To conserve on power, the push-to-talk switch 21 which is mounted on the side of the pen 12 is used to apply power to the microphone 20 whenever the user wishes to speak into the microphone 20. As in the case of Fig. 2, the tip region 18 of the pen 12 of Fig. 3 physically interacts with the touch-screen 16 formed in conjunction with the LCD display 44, as represented by the dotted line 48.

The electronic portion of the pen 12 of Fig. 3 is shown in Fig. 4. As previously described, the microphone 20 responds to words spoken by the user to produce the analog voice signals. Such analog voice signals are amplified in an audio amplifier 54. The audio amplifier 54 conditions the signal for proper application to a voltage controlled oscillator (VCO) 56 to frequency modulate (FM) a signal at the output of the VCO 56 in accordance with the analog audio signal from the amplifier 54. The output of the VCO 56 is conditioned by a driver circuit 58 prior to driving an infrared (IR) transmitter 60.

The pen 12 is powered by batteries 62. Because there is no memory or microprocessor in the pen 12, there is no need to keep the pen 12 powered when not in use. Accordingly, the push-to-talk switch 21 is used to provide the power from the batteries 62 only when the user wishes to speak into the microphone 20. Pressing the push-to-talk switch 21 at the outer surface of the pen 12 couples the batteries 62 to a voltage regulator 64. The voltage regulator 64, which is coupled between a common ground line 66 and the push-to-talk switch 21, has an output terminal 68 thereof coupled to provide a power supply voltage (+V) at a terminal 70. This regulated supply voltage is applied to the microphone 20, the audio amplifier 54 and the VCO 56. The batteries 62 are directly coupled to the driver 58 by the push-to-talk switch 21. The

regulated supply voltage +V optimizes the operating conditions of the VCO 56.

Whenever the user wishes to transmit a voice command to the electronic device 14, the user pushes the push-to-talk switch 21 and speaks the voice command into the microphone 20 of the pen 12. The resulting analog audio signal is amplified by the amplifier 54 and applied to the VCO 56 to frequency modulate the output of the VCO 56. This FM signal is applied via the driver 58 to the infrared transmitter 60, for transmission as an infrared signal to the electronic device 14. When the user is not transmitting voice commands, the push-to-talk switch 21 is open, and the batteries 62 are not coupled to the voltage regulator 64 or to the driver 58.

When the user pushes the push-to-talk switch 21 and speaks a command word into the microphone 20, the pen 12 transmits a frequency modulated infrared signal from the infrared transmitter 60. The infrared transmitter 60 may comprise an infrared diode or other appropriate infrared transmitting device. Such infrared signals are sensed by an infrared (IR) sensor 72 forming a part of the audio receiver 50, as shown in Fig. 3. A detailed example of the audio receiver 50 is shown in Fig. 5.

Referring to Fig. 5, the infrared sensor 72, which may comprise any appropriate form of infrared sensor such as those typically used in remote control devices, provides the received signal for amplification by an amplifier 74 and filtering by a filter 76. The output of the filter 76 is applied to a phase-locked loop receiver 78 which demodulates the frequency modulated signal by converting it to a voice signal. The phase-locked loop receiver 78 is of conventional phase-locked loop (PLL) configuration, and includes a phase detector 80 coupled to the filter 76 and having an output and a second input coupled in a loop which includes a loop

filter 82 and a voltage controlled oscillator (VCO) 84. The output of the phase-locked loop receiver 78 is filtered by an audio filter 86 and amplified by an audio amplifier 88 to provide the demodulated voice signal. The phase-locked loop receiver 78 also provides a lock detect signal, which indicates when a transmitted signal is present in the audio receiver 50.

The phase-locked loop receiver 78 is described herein by way of example only, and it should be understood that other demodulation receivers can be used as desired. For example, a super-heterodyne receiver can be used in applications posing more stringent requirements.

Voice control of the electronic device 14 within the voice and pointer operated system 10 is made possible by first voice training the collection of reference digital voice templates in the voice recognition circuit 26 in accordance with the user's voice. Such templates are collected in the same manner as described in co-pending application Serial No. 07/915,112. The LCD display 44 of the device 14 is used to provide displays which prompt the user by requesting the needed words. The user responds, with the push-to-talk switch 21 being pushed, by speaking the prompted word into the microphone 20 of the pen 12.

As previously noted, the electronic device 14 in the example of Fig. 1 comprises a personal digital assistant (PDA) capable of input and retrieval of a phone directory. The LCD display 44 of the device 14 is employed to display a list of names and phone numbers. By touching a button labeled "add", displayed on the LCD display 44 with the tip region 18 of the pen 12, a blank entry with boxes for the name, voice training, country code, area code, phone numbers, address and notes is placed at the end of the list.

The user is also given the option of adding additional phone numbers and alternate addresses per entry, if desired. The user may randomly select fields to input data, by touching such fields with the pen 12. For example, if the user touches a "name" box on the LCD display 44 with the pen 12, the name is input using the keyboard input 38, or by voice, spelling each word. The user can then touch a "voice" button and speak the person's name into the microphone 20 of the pen 12 in order to create a recording of the name. The user can then touch an "area code" box and speak the digits for the area code, or the user can touch the "phone number" box and speak the digits of the phone number, to complete the entry. The various fields are optional and can be selected in any order. If the user decides not to input data into a field, the field is left blank. A detailed example of this operation is provided hereafter in connection with Figs. 6 and 7.

To retrieve a phone number, the user touches a "search" button on the LCD display 44 using the pen 12, and speaks the name of the person the user wishes to call. The person's name, phone number, and any other available information is immediately displayed on the LCD display 44, and the recording of the name is spoken back to the user for confirmation, using the audio circuit 40 and the speaker 42 shown in the arrangements of Figs. 2 and 3. Alternatively, the device 14 can be programmed to speak the phone number and other information or to dial the number if connected to a telephone.

The flow chart of Fig. 6 illustrates the manner in which the user inputs all of the information normally found in an address book. For simplicity of illustration, the flow chart of Fig. 6 shows only one path through the various fields. However, it should be understood that the user can input such information in any order desired.

Referring to the flow chart example of Fig. 6, in a first step 90 the user requests a new entry in the directory, and does so by touching a button labeled "add" with the pen 12. The user then chooses to input the name first, by touching the "name" field with the pen 12, in a step 92. The "name" field is highlighted, and the user then types the person's name using the keyboard input 38, in a step 94. This highlights the "record" field. The user then holds the push-to-talk switch 21 on the pen 12 and speaks the person's name, in a step 96.

Upon speaking the person's name, in the step 96, the "address" field is highlighted upon release of the push-to-talk switch 21. In a step 98, the user types in the address using the keyboard input 38. Alternatively, the user may record the address by speaking the address into the microphone 20 of the pen 12 in a step 100. As a further alternative, the user can speak the digits of the street number into the pen 12, in a step 102, and then type the street name using the keyboard input 38, in a following step 104.

Following entry of the address, the "phone number" field is highlighted. The user may type the phone number using the keyboard input 38, in a step 106. Alternatively, the user may speak the digits of the phone number into the pen 12, in a step 108. As shown by a subsequent step 110, the address entry is automatically saved when an "enter" key on the keyboard entry 38 is pressed, or the push-to-talk switch 21 on the pen 12 is released, or one of the on-screen icons such as "save" or "new entry" is touched.

The flow chart of Fig. 7 provides a more detailed example of the manner in which the user can randomly select fields and input information in any order. For simplicity of illustration, the flow chart of Fig. 7 is confined to entry of a phone number. Nevertheless, the

flow chart of Fig. 7 demonstrates the ease and flexibility with which the user may enter information.

As illustrated by an elongated box 120 at the top of Fig. 7, the user has chosen to start a new phone number entry. The user may touch a "country" field, as illustrated in a step 122. If so, and as illustrated in a following step 124, the country code field is highlighted and the device 14 waits for the user to press the push-to-talk switch 21 on the pen 12 (again assuming the wireless example of Fig. 3). By pushing the push-to-talk switch 21 on the pen 12, in a step 126, the device 14 is ready to interpret each spoken word and to append the result to the number in the country code field, until the push-to-talk switch 21 is released or the field is full, as illustrated in a step 128. Release of the push-to-talk switch 21 results in the device 14 highlighting the country code field (step 124). If the field is full, the box 120 at the top of Fig. 7 is returned to.

From the starting box 120, the user may also touch an "area code" field, in a step 130, and this highlights the area code field and waits for the user to press the push-to-talk switch 21 in a step 132. If the user presses the push-to-talk switch 21 in a step 134, the device 14 interprets each spoken word and appends the result to the number in the area code field, until either the user releases the button or the field is full, as shown in a step 136. Release of the push-to-talk switch 21 results in the highlighting of the area code field (step 136). If the field is filled, the starting box 120 is returned to.

From the starting box 120 at the top of Fig. 7, the user may also touch a "phone number" field in a step 138, and this highlights the phone number field and causes the device 14 to wait for the user to press the push-to-talk switch 21, in a step 140. If the user then presses the push-to-talk switch 21, in a step 142,

the device 14 interprets each spoken word and appends the result to the number in the phone number field, until the user releases the push-to-talk switch 21 or the field is full, as illustrated in a step 144. If the user releases the push-to-talk switch 21, the phone number field is highlighted (step 140). If the field is filled, the starting box 120 is returned to.

As shown by the various lines and arrows in Fig. 7, from the step 124 in which the country code field is highlighted, the user may move to the step 130 or the step 138 for highlighting of the area code field or the phone number field respectively. Similarly, from the step 132 in which the area code field is highlighted, the user can move to either the step 138, or to the step 122 in which the country code is highlighted. The step 140 in which the phone number field is highlighted can also result in the user moving to either the step 122 or the step 130. This illustrates the flexibility of the system and the fact that fields can be selected and information input thereto randomly and in any order.

It is possible for two or more users to use the same electronic device 14. Each such user trains his or her voice, with the resulting templates being stored separately from the templates of the other user or users. Thereafter, and in accordance with one technique, a particular user initiates use of the device 14 by speaking his or her name, at an appropriate word group, and this results in the device 14 using that person's voice templates. Once the name is recognized, the LCD display 44 shows the user's name and uses that person's voice templates, until the name is changed. Even if the device 14 is turned off, the device continues to identify that person and his or her voice templates when again turned on. This technique for use of the electronic device 14 by multiple users has the advantage that the electronic device 14 need

not have components added thereto to support the multiple voice capability. Also, the users do not have to remember a number on a switch or other device corresponding to their voice. However, the word groups must be increased by addition of more words, and it is difficult to constantly determine which user's voice templates are currently being used.

Accordingly, an alternative approach to accommodating multiple users of the electronic device 14 involves the addition of a multiple position switch to the device 14. Positioning such switch to a number corresponding to a particular one of multiple users results in the device 14 using that person's voice templates.

While various forms and modifications have been suggested, it will be appreciated that the invention is not limited thereto but encompasses all expedients and variations falling within the scope of the appended claims.

WHAT IS CLAIMED IS:

1. A voice and pointer operated system comprising the combination of:

a pen responsive to a voice command for providing a voice signal; and

a device having a pointer-responsive area thereon and including voice recognition means for recognizing the voice signal and producing an action routine denoted thereby.

2. A voice and pointer operated system in accordance with claim 1, wherein the pen has a tip region for interacting with the pointer-responsive area of the device and a microphone responsive to the voice command.

3. A voice and pointer operated system in accordance with claim 1, wherein the pointer-responsive area of the device comprises a touch screen.

4. A voice and pointer operated system in accordance with claim 1, wherein the pen is electrically coupled to the device to provide the voice signal thereto.

5. A voice and pointer operated system in accordance with claim 1, wherein the pen includes means responsive to the voice command for transmitting a representation of the voice command, and the device includes means responsive to the transmitted representation of the voice command for providing the voice signal.

6. A voice and pointer operated system in accordance with claim 5, wherein the means for transmitting includes an infrared transmitter and the means responsive to the transmitted representation includes an infrared sensor.

7. A voice and pointer operated system in accordance with claim 5, wherein the pen includes means for converting the voice command into an analog signal and means for modulating the analog signal to produce a transmission signal, and the device includes means for demodulating the transmission signal.

8. A voice and pointer operated system in accordance with claim 1, wherein the voice recognition means includes a reference memory for storing a plurality of reference voice templates, a program memory for storing a control program, and a processor coupled to the reference memory and the program memory for generating an incoming voice template in response to each voice signal produced by the means for producing a voice signal corresponding to the transmitted representation, and for executing the control program to determine whether the incoming voice template is substantially equivalent to one of the reference voice templates, and for selecting one of a plurality of action routines based on the incoming voice template.

9. A method of controlling, by voice command and by pointing, a control device, comprising the steps of:

pointing to a specific area of the control device to interact with and input data into the control device; and

responding to a voice command by providing a corresponding voice signal to the control device.

10. A method of controlling in accordance with claim 9, wherein the steps of pointing and responding are carried out simultaneously.

11. A method of controlling in accordance with claim 9, comprising the further steps of responding to the voice signal at the control device by performing voice recognition of the voice signal and providing an action routine to the control device in accordance with the voice recognition performed on the voice signal.

12. A method of controlling in accordance with claim 9, wherein the step of responding to a voice command by providing a corresponding voice signal to the control device comprises the steps of converting the voice command, transmitting the converted voice command to the control device and converting the transmitted converted voice command into a voice signal at the control device.

13. A pen for interacting with a touch screen, comprising the combination of:

an elongated pen having a tip region for interacting with a touch screen; and

means contained within the pen and responsive to a voice command for providing a voice signal.

14. A pen in accordance with claim 13, wherein the means for providing a voice signal comprises a microphone.

15. A pen in accordance with claim 14, wherein the microphone is mounted at an end of the elongated pen opposite the tip region.

16. A pen in accordance with claim 13, wherein the means for providing a voice signal includes means responsive to the voice command for transmitting a corresponding signal.

17. A pen in accordance with claim 13, wherein the means for providing a voice signal includes means responsive to the voice command for producing a corresponding analog voice signal, means for modulating the analog voice signal and means for transmitting the modulated analog voice signal.

18. A device for operating in response to a voice signal and to interaction with a pen comprising the combination of:

means responsive to the voice signal for performing voice recognition thereon;

means responsive to the voice recognition for producing an action routine within the device; and

means responsive to interaction with a pen for performing a function with the device.

19. A device in accordance with claim 18, wherein the means responsive to interaction with a pen includes a touch screen mounted on the device.

20. A device in accordance with claim 18, further comprising means for sensing a transmitted modulated audio signal and means for demodulating a sensed signal to produce the voice signal.

21. A method of making entries in a directory stored in an electronic device, the electronic device including a display having a plurality of touch-responsive fields and means for recognizing words spoken by a user, comprising the steps of:

touching a name field on the display;

manually entering a name into the device;

speaking the name to enter it into the device;

entering an address for the name into the device; and

entering a phone number for the name into the device.

22. A method in accordance with claim 21, wherein the step of touching a name field is carried out using a pen, and the step of speaking the name comprises speaking the name into the pen so that the pen transmits a corresponding voice signal to the device.

23. A method in accordance with claim 22, wherein the step of entering an address for the name comprises speaking the address into the pen so that the pen transmits a corresponding voice signal to the device.

24. A method in accordance with claim 22, wherein the step of entering a phone number for the name comprises speaking the phone number into the pen so that the pen transmits a corresponding voice signal to the device.

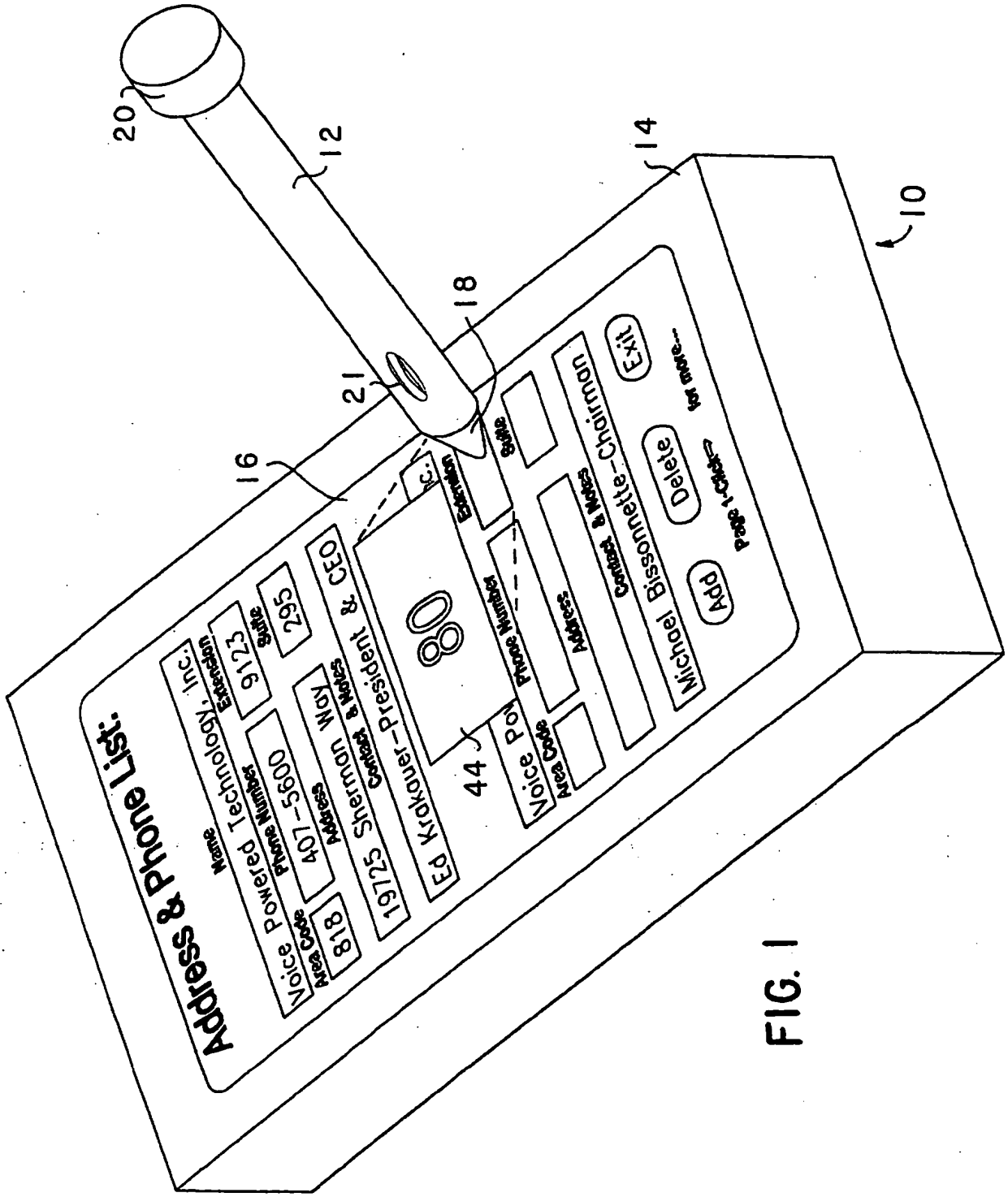
20
12
14
10
18
21
16
Address & Phone List:
Name
Technology, Inc.
Extension
9123
Suite
295
Voice Powered
Phone Number
407-5600
Area Code
818
Address
Sherman Way
Contact & Notes
CEO
19725
President &
80
Ed Krakauer
44
Voice Pol
Phone Number
Area Code
Address
Suite
Extension
Contact & Notes
Chairman
Exit
Michael Bissonnette
Delete
Add

FIG. 1

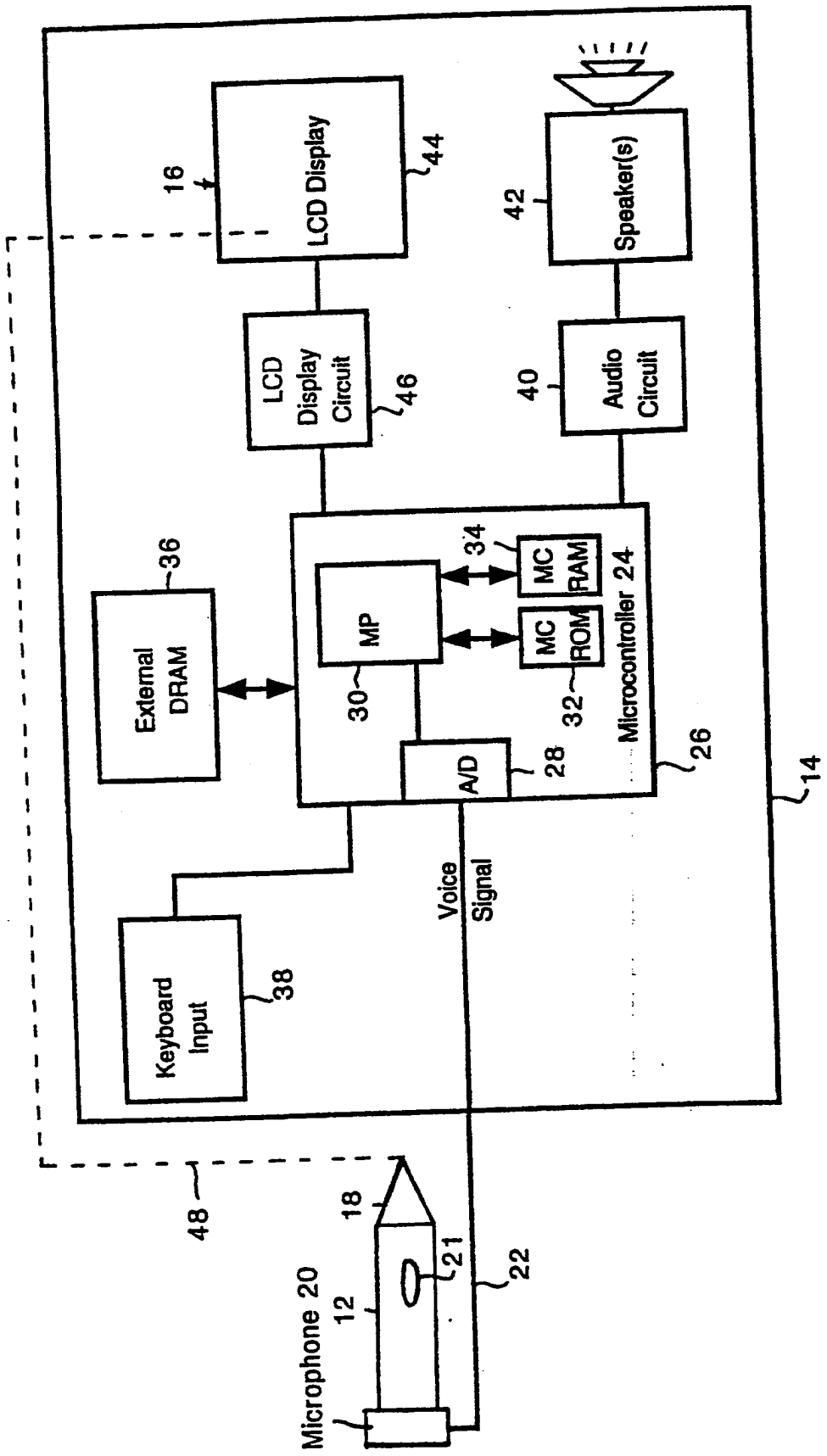

FIG. 2

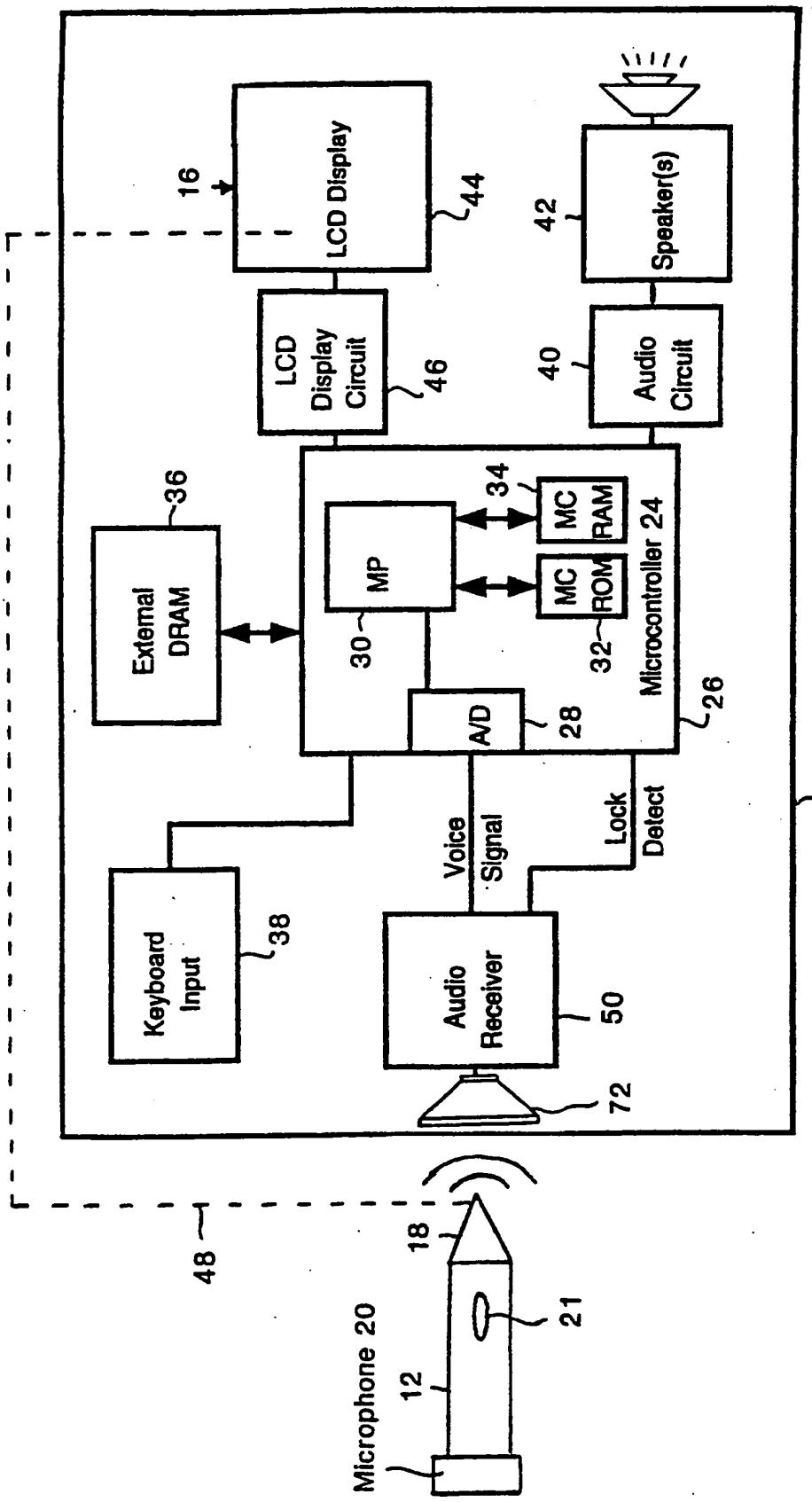

FIG. 3

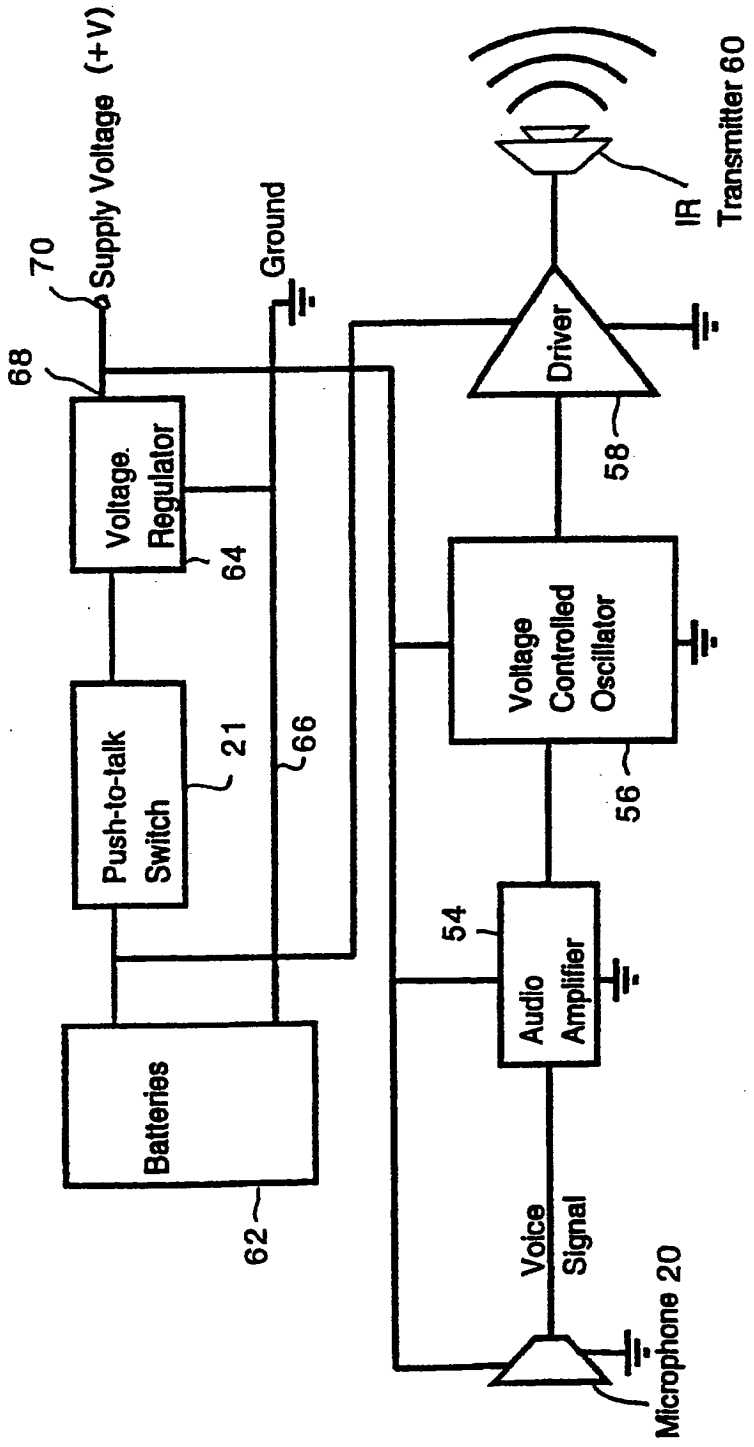

FIG. 4

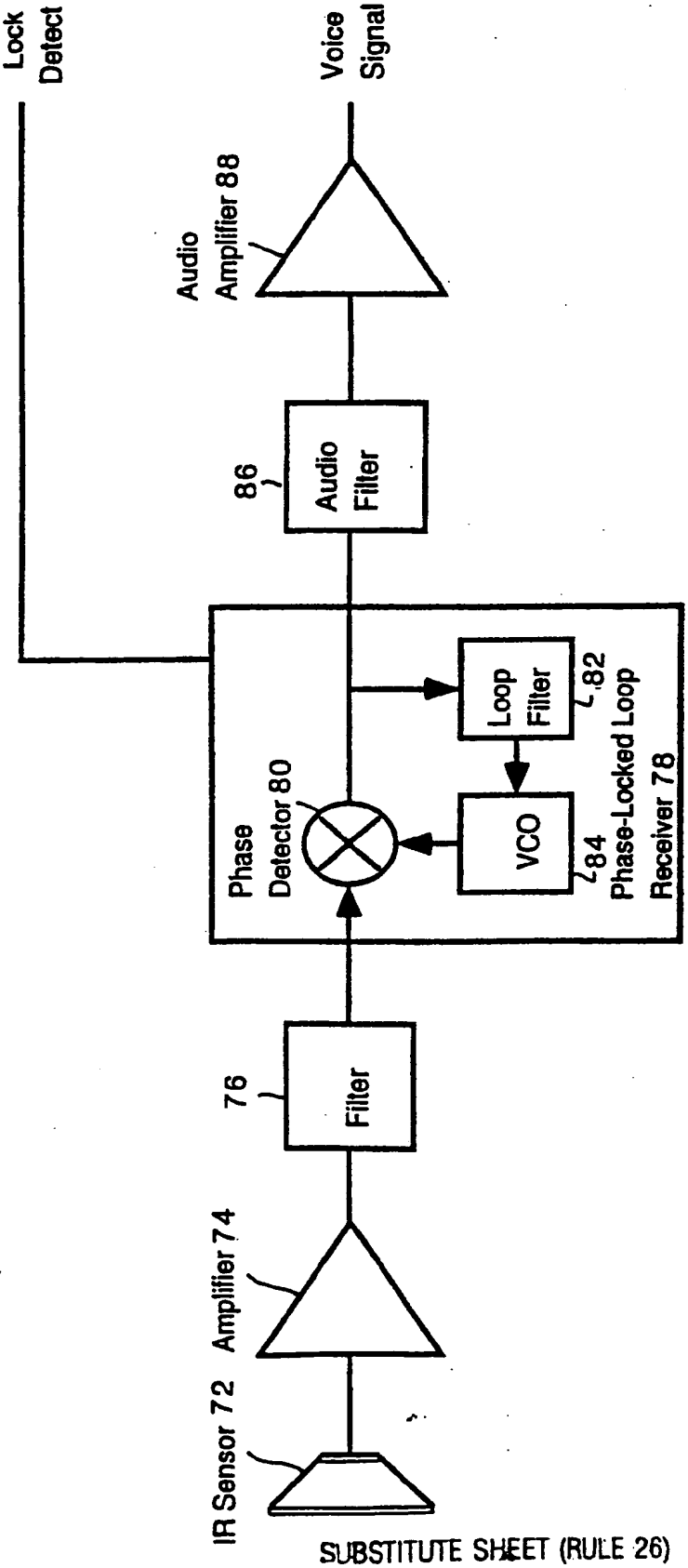

FIG. 5

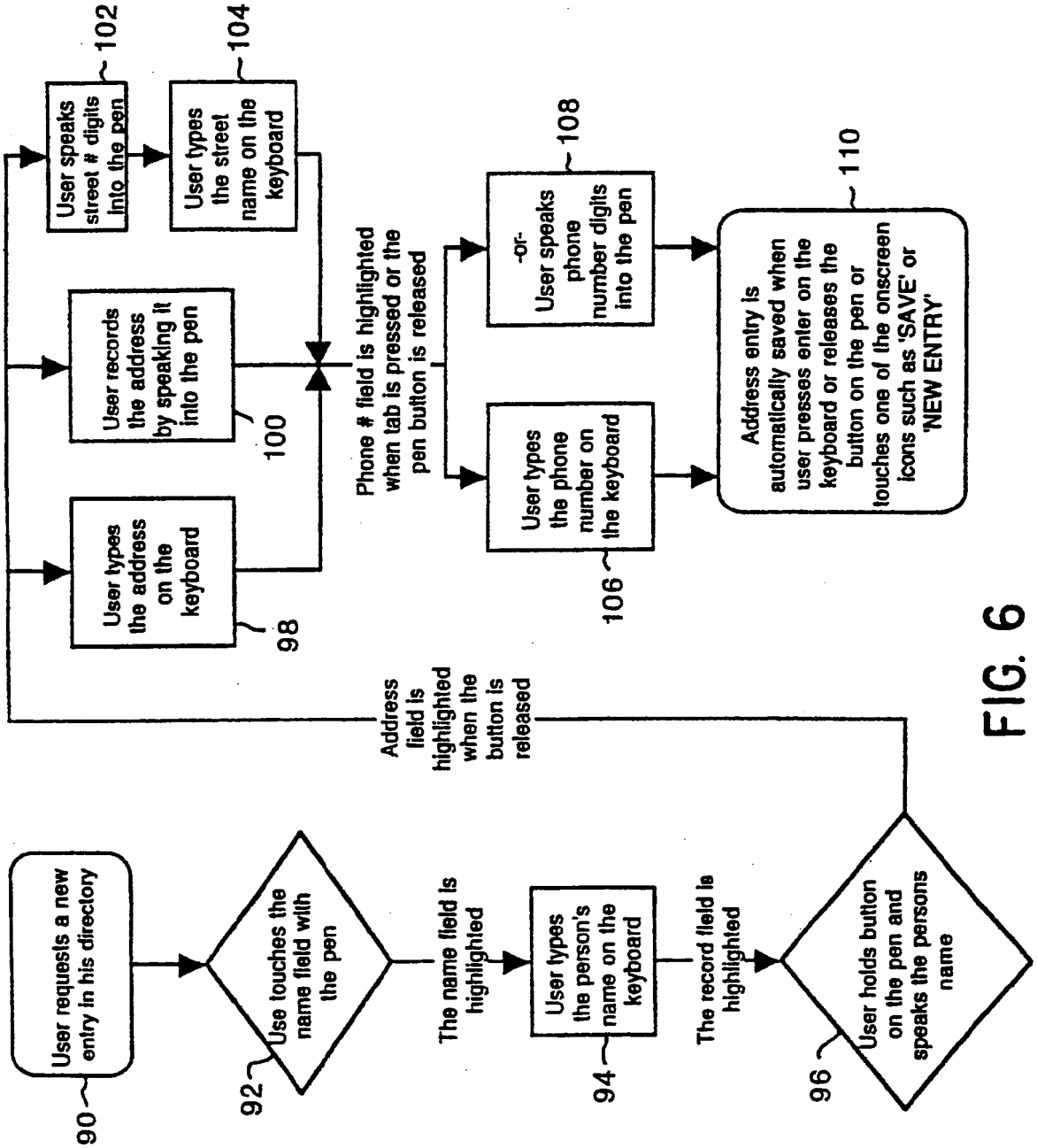
User requests a new entry in his directory
90
Use touches the name field with the pen
92
The name field is highlighted
User types the person's name on the keyboard
94
The record field is highlighted
User holds button on the pen and speaks the persons name
96
Address field is highlighted when the button is released
User types the address on the keyboard
98
User records the address by speaking it into the pen
100
User speaks street # digits into the pen
102
User types the street name on the keyboard
104
Phone # field is highlighted when tab is pressed or the pen button is released
User types the phone number on the keyboard
106
-or-
User speaks phone number digits into the pen
108
Address entry is automatically saved when user presses enter on the keyboard or releases the button on the pen or touches one of the onscreen icons such as 'SAVE' or 'NEW ENTRY'
110

FIG. 6

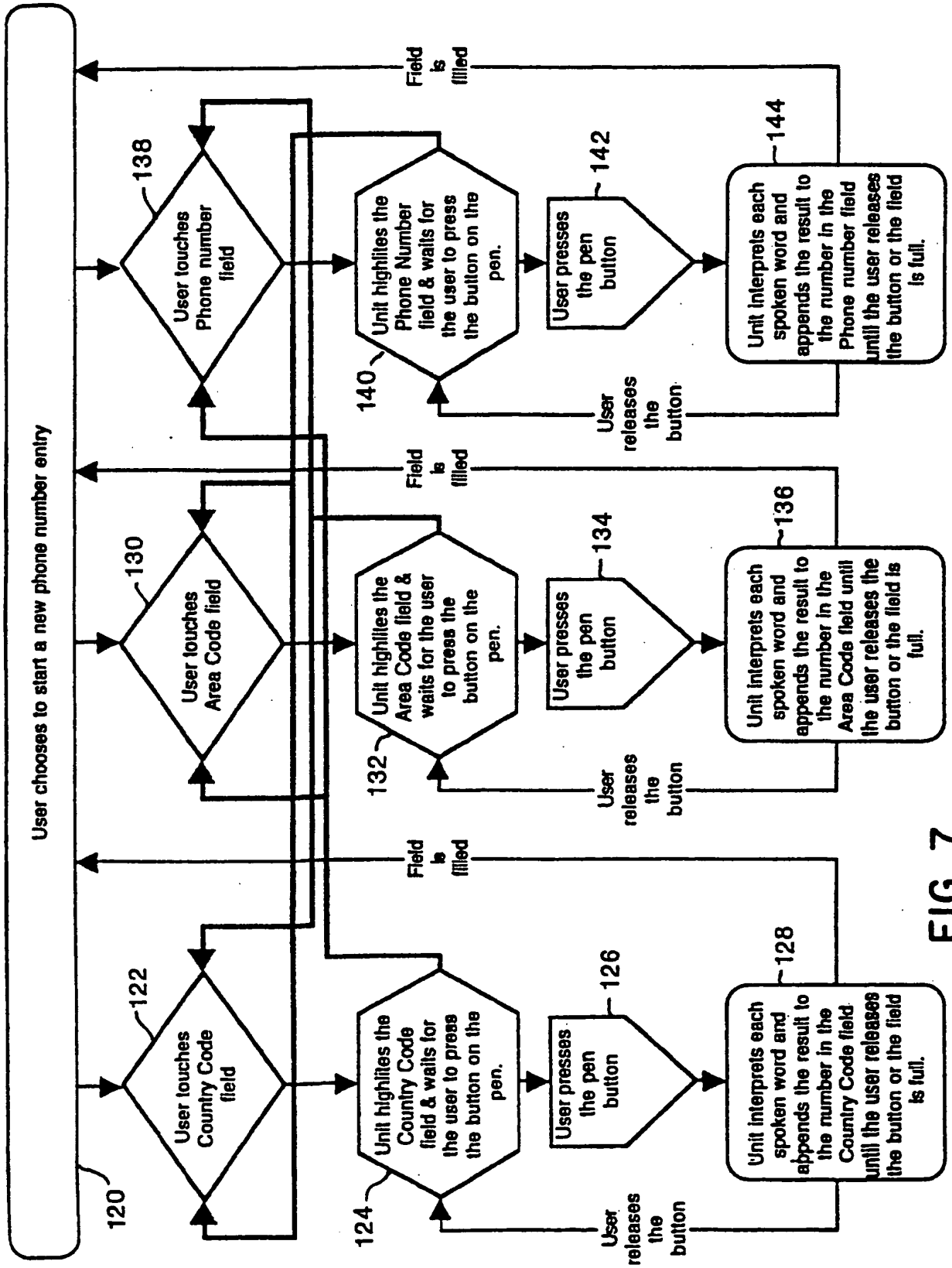

FIG. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US95/02921

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :G10L 9/00
US CL :395/2.4, 2.44
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 395/2.4, 2.44, 2.79, 11, 12

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

APS, IEEE CD ROM LIBRARY
search terms: PDA, voice command, portable computer, pointing device

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US, A, 4,495,646 (GHARACHORLOO) 22 January 1985, Fig 1.	1-20
Y	US, A, 4,811,243 (RACINE) 07 March 1989, Figs 1 and 2, col. 4, lines 46-56.	1-24
Y	US, A, 4,914,704 (COLE ET AL) 03 April 1990, Fig 1.	1-24
A	US, A, 5,063,600 (NORWOOD) 05 November 1991, Fig 1A.	1-24
Y	US, A, 5,148,155 (MARTIN ET AL) 15 September 1992, Fig 1, col. 7, line 39 to col. 8, line 10.	1-24
Y, P	US, A, 5,309,359 (KATZ ET AL) 03 May 1994, Fig 1.	1-24

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be part of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 13 APRIL 1995	Date of mailing of the international search report 02 JUN 1995
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer ALLEN MACDONALD Joni Hill Telephone No. (703) 305-9600

Form PCT/ISA/210 (second sheet)(July 1992)*

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US95/02921

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y,P	US, A, 5,347,477 (LEE) 13 September 1994, Fig 5.	1-24
A,P	US, A, 5,365,434 (FIGLIUZZI) 15 November 1994, Fig 2.	1-24